



AMS Tracker Thermal Control Subsystem TTCB EMC/EMI operation procedure Part B

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Document change log

<u>Change Ref.</u>	<u>Section(s)</u>	<u>Issue 1.0</u>
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1 Scope of the document and test objective

During EMC/EMI test components of the TTCB need to operational. This document contains operation procedure sheets for the TTCB during EMC and EMC and does not include the EMC/EMI test procedure.

2 Hardware under test

The hardware the TTCB-p or TTCB-s are the flight modules. The TTCB shall be operational during EMC/EMI test and therefore will be connected to Ground Support Equipment to form a closed loop filled with CO₂. The GSE-loop will be equipped with a mass flow meter, absolute pressure transducer, differential pressure transducer and temperature sensors.

3 Test Requirements

During the emissivity test the following actuator will be switched on to measure the emission. If possible the actuators will be switched on separately, no other actuators active or as less as possible.

	Actuator	Pump running	comment
1	Peltier elements	no	PWM, TBD %
2	Accumulator heater FAC	no	PWM, , TBD %
3	TTCB pump	yes	3500, 6000, 10000 RPM
4	Pre-heater	yes (minimal flow)	Auto control
5	Start Up Heater	yes (minimal flow)	Manual ON/OFF (2s/10s)
6	Cold Orbit Heater	yes (minimal flow)	Manual ON/OFF (2s/10s)

4 Test facility/equipment description

The test is performed at SERMS (Terni) at the EMC/EMI test facility and the following type of equipment will be used for operating the TTCB:

- TTCE / cables / CAN-if / pc with TTCE sw
- CO₂
- Mass flow meter
- Absolute transducer

- Differential pressure transducer
- Temperature sensors, TC type T
- NI cDAQ system
- Pc with LV sw
- Thermostat bath for cooling CO₂ (GSE-loop)

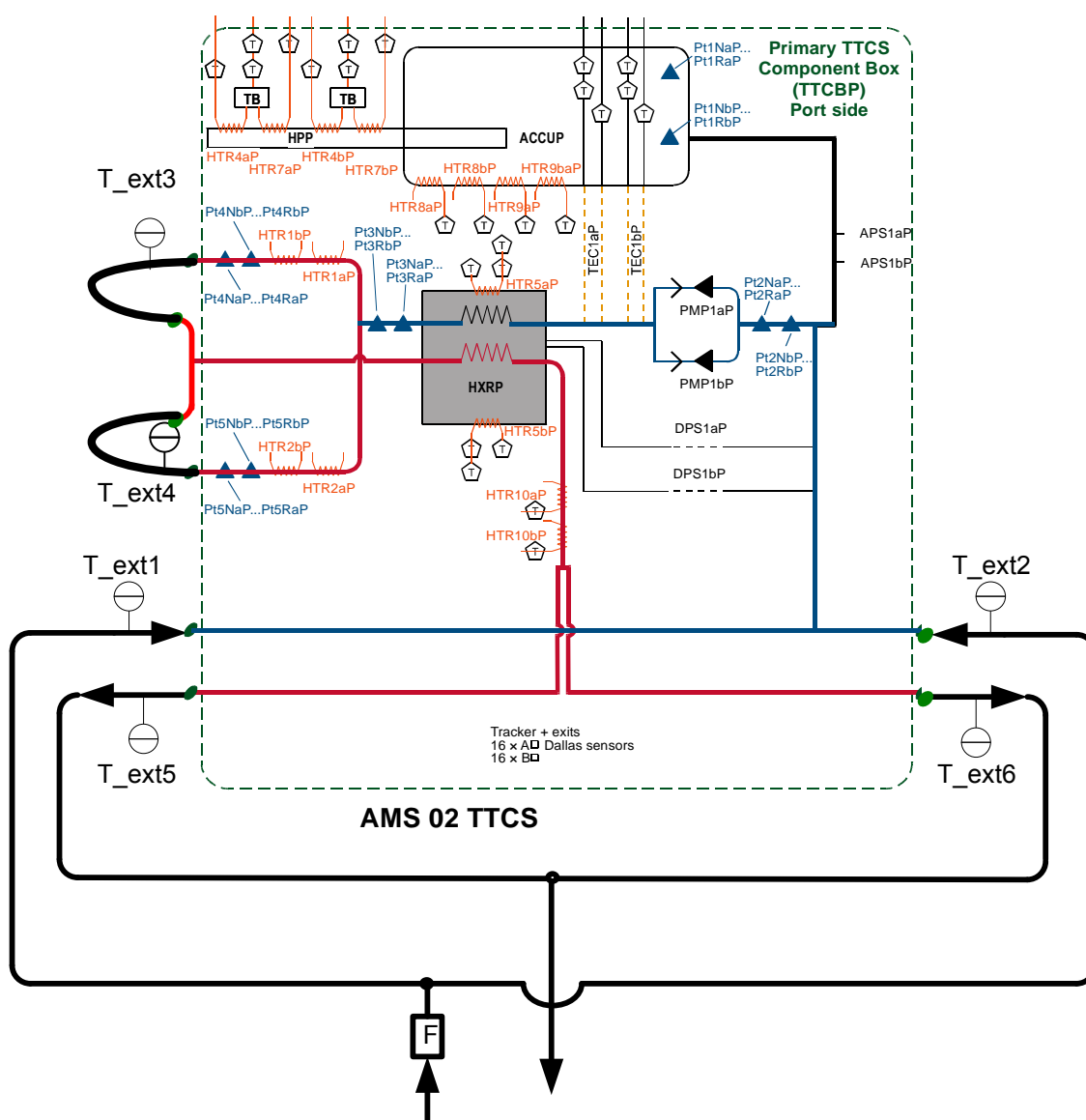


Figure 4-1: TTCB schematic with additional tubing for functional test



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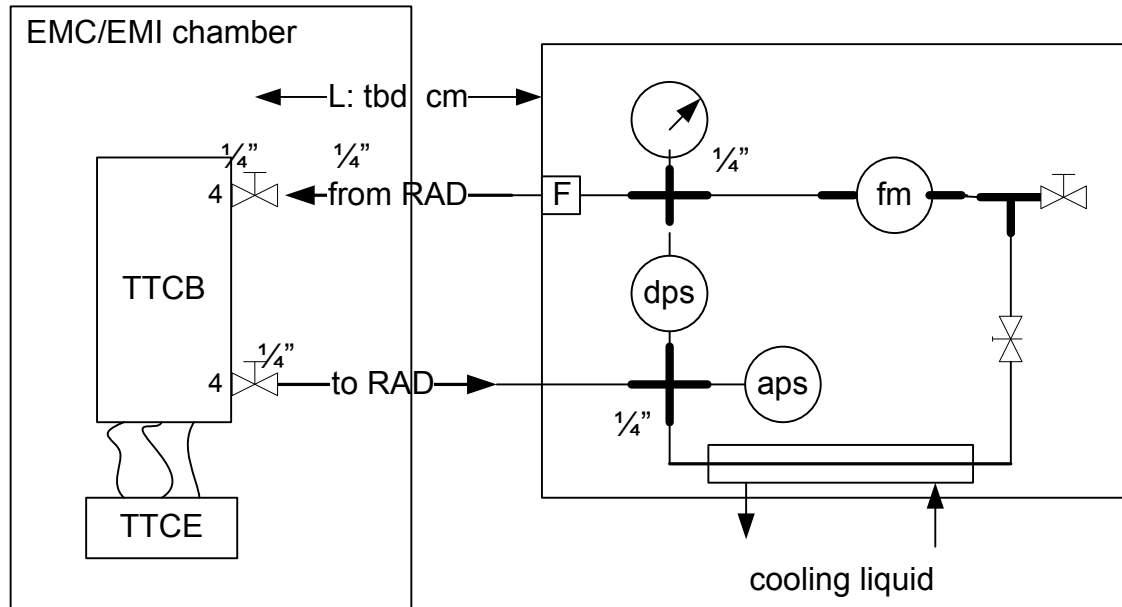


Figure 4-2: schematic with GSE for operating TTCB



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5 TTCB EMC/EMI Test Part B in main steps

The EMC/EMI overall test sequence is:

Test Abbreviation	Test name and Frequency range
-------------------	-------------------------------

Day 1 2009-06-10

	Radiated Emission Test		14 KHz	15.5 GHz
A	KHz	14	150 KHz	
B	KHz	150	30 MHz	
C (Hor)	MHz	30	300 MHz	POL H
C (Ver)	MHz	30	300 MHz	POL V
D (Hor)	MHz	300	700 MHz	POL H
D (Ver)	MHz	300	700 MHz	POL V
E (Hor)	GHz	700	1 GHz	POL H
E (Ver)	GHz	700	1 GHz	POL V
F (Hor)	GHz	1	15.5 GHz	POL H
F (Ver)	GHz	1	15.5 GHz	POL V

Day 2 2009-06-11

	Radiated Spikes		(RS-02)		
				minutes	# TTCB CONF
Spike 1	pulses		10 micro	1	13
Spike 2			150 nano	1	13

	Radiated	Electric field level		(RS03)	
G	KhZ	14	10	Mhz	
H (Hor)	MHz	200	1	GHz	POL H
H (Ver)	MHz	200	1	GHz	POL V
I (Hor)	GHz	1	2	GHz	POL H
I (Ver)	GHz	1	2	GHz	POL V
J (Hor)	GHz	2	4	GHz	POL H
J (Ver)	GHz	2	4	GHz	POL V
K (Hor)	GHz	4	8	GHz	POL H
K (Ver)	GHz	4	8	GHz	POL V
L (Hor)	GHz	8	10	GHz	POL H
L (Ver)	GHz	8	10	GHz	POL V
M (Hor)	GHz	2.2		GHz	POL H
M (Ver)	GHz	2.2		GHz	POL V
N (Hor)	GHz	8.5		GHz	POL H
N (Ver)	GHz	8.5		GHz	POL V
O (Hor)	GHz	13.7	15.2	GHz	POL H
O (Ver)	GHz	13.7	15.2	GHz	POL V

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Part A the radiated emission test is performed on June 10.

The main test steps of Part B (to be performed on June 11 and (if needed) June 12) are:

1. Operate TTCB and conduct EMC/EMI test
2. Perform pre-test Health check (see sheets) TTCE-A & TTCE-B
 - a. Dallas sensor and Pt 1000 check
 - b. DPS, APS check
 - c. TEC cooler check
3. Perform Spike 1 Test
 - a. Pump operation test (3500, 6000, 10000 rpm)
 - b. TEC Cooler operation
4. Perform Health check (see sheets)
5. Perform Spike 2 Test
6. Perform Health check (see sheets)
7. Perform test G
8. Perform Health check (see sheets)
9. Perform test H (Hor)
10. Perform Health check (see sheets)
11. Perform test H (Ver)
12. Perform Health check (see sheets)
13.
14.
15.
16.
17.
18. Perform test O (Hor)
19. Perform Health check (see sheets)
20. Perform test O (Ver)
- 21. Perform Functional Check according to AMSTR-NLR-PR-028**
22. Empty TTCB
23. Dis-connect TTCB from TCCE
24. Transport TTCE to TV-chamber for TTCB-S TV testing

All tests need to be done for TTCE-A and TTCE-B.

6 References documents

	Title	Number	Date
RD-1	TTCS Requirements Verification Matrix FM H/W	AMSTR-NLR-PL-02 Issue 1.0	April 2007
	Filling procedure		



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7 TTCB EMC/EMI operation procedure

7.1 The TTCB EMC/EMI operation procedure

The TTCB EMC/EMI operation procedure sheets shall be filled in, and shall accompany the TTCB during it's lifetime in order to be able to show the procedure was followed.

During the EMC/EMI test the environment can not be cooled. Therefore it might be necessary to pause in between the EMC/EMI test steps to condition the environment or cool down the TTCB itself for safe operation of the TTCB actuators. The procedure has been written assuming an environment temperature of 20 °C or lower and humidity as low as possible.



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7.2 TTCB EMC/EMI operation procedure sheets

TTCB EMC/EMI operation procedure sheets			company:		Date & Time:	
Fill in by hand.			engineer:		location:	
Step	Action	Monitoring	Value	Result	Comment	√
1.	Record model TTCB	model	P			
2.	Verify TTCB Tenviroment (check in chamber whenever possible) Or Check DS09 I/F USS or DS16 (spare DS in box air)	Tenviroment	$T \leq 20^{\circ}\text{C}$ DS 09 & DS16			
3.	Verify subcooling	Pt01, Pt02	Pt01-Pt02 $>4^{\circ}\text{C}$			
4.	Verify Setpoint and pressure		Pt01 $< 25^{\circ}\text{C}$ P < 65 bar			
5.	Identification EMI/EMC set-up (and write down field range)	(A...O)	Range			
6.	TTCE identification	(A or B)				
7.	Pump test 3500 rpm V=1040 mV					
8.	During long tests monitor Tsubcooling, Tenviroment, Pabs During long tests switch FAC automatic control on		Pt01-Pt02 $>4^{\circ}\text{C}$ XX $< \text{Pt01} < 25^{\circ}\text{C}$ P < 65 bar			
9.	Pump test 6000 rpm V=1904 mV					
10.	During long tests monitor Tsubcooling, Tenviroment, Pabs During long tests switch FAC automatic control on		Pt01-Pt02 $>4^{\circ}\text{C}$ XX $< \text{Pt01} < 25^{\circ}\text{C}$ P < 65 bar			



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TTCB EMC/EMI operation procedure sheets			company:		Date & Time:	
Fill in by hand.			engineer:		location:	
Step	Action	Monitoring	Value	Result	Comment	√
11.	Identification EMI/EMC set-up (and write down field range)	(A...O)	Range			
12.	TTCE identification	(A or B)				
13.	Pump test 10000 rpm V=3296 mV					
14.	During long tests monitor Tsubcooling, Tenviroment, Pabs During long tests switch FAC automatic control on		Pt01-Pt02 >4 °C XX<Pt01< 25°C P < 65 bar			
	Peltier test					
15.	Set / control Taccu to 23 °C	Pt01	Pt01 = 23 °C			
16.	Execute “ EMC accu peltier test ”, monitor Tcopper saddle & system pressure. (switch on peltier 10 %)	DS07 DS08 pressure	DS07 < 25°C DS08 < 25°C P < 65 bar			
17.	If Tcopper saddle or pressure too high then stop “EMC accu peltier test” and cooling down TTCB hw with thermal bath and/or cool down EMC test chamber and continue test					
18.	Verify subcooling, pressure and environment. If possible cool down chamber (as lots of heat is dissipated) By opening the door.		Pt01-Pt02 >4 °C XX<Pt01< 25°C P < 65 bar			



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7.3 TTCB EMC/EMI health check

TTCB functional check procedure sheet				company:		Date & Time:	
Fill in by hand.				engineer:		location:	
Step	Action	Monitoring	Value	Post-test result		Comment	√
1.	Identification EMI/EMC set-up	(A...O)	Range				
2.	TTCE identification	(A or B)					
3.	Verify TTCB Tenviroment (check in chamber whenever possible) Or Check DS09 I/F USS or DS16 (spare DS in box air)	Tenviroment	$T \leq 20^{\circ}\text{C}$ DS 09 & DS16				
4.	Run the thermal bath		$5 \pm 1^{\circ}\text{C}$				
5.	Switch-off all components on TTCE side and read the voltage and current value	V, I	$28 \pm 0.1\text{V}$, $0.36 \pm 0.01\text{A}$				
6.	Read all T and P sensors Report anomolies	T, P	T °C Psat				
7.	Switch on FAC automatic control and pump 5000 rpm		$23 \pm 2^{\circ}\text{C}$				
8.	Check if the accumulator temperature is stable at $23 \pm 2^{\circ}\text{C}$	Pt01	$23 \pm 2^{\circ}\text{C}$				
9.	Disable automatic accumulator control						
10.	Read the power supply output	V & I					
11.	Turn on TEC_a with 90% of full power and record time	time					



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TTCB functional check procedure sheet				company:		Date & Time:	
Fill in by hand.				engineer:		location:	
Step	Action	Monitoring	Value	Post-test result		Comment	√
12.	Identification EMI/EMC set-up	(A...O)	Range				
13.	TTCE identification	(A or B)					
14.	Read the power supply output. Calculate power consumption of TEC_a	V & I V*ΔI					
15.	Turn off TEC_a when the accumulator temperature decreased 1-2°C read the accumulator temperature and record time Read DS05, DS06, DS07, DS08	Pt1 time	Somewhere in between 23-20 °C				
16.	Write down the cooling rate	ΔT/min					
17.	Read the power supply output	V & I					
18.	Turn on FAC_a with 90% of full power and record the time for increase of 2 C	time					
19.	Read the power supply output Calculate resistance and power consumption of FAC_a	V & I R = V/ ΔI P = V*ΔI	20.9±2Ω 40W				
20.	Turn off FAC_a when the accumulator temperature increased 1-2°Cand record time	Pt01 time	21-24 °C				
21.	Write down the maximum heating rate	ΔT/min					
22.	FAC automatic control & reduce environment if needed		23 °C				



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